PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-221540
(43)Date of publication of application : 11.08.2000

(51)Int.Cl. G02F 1/136

(21)Application number : 11-022517
(22)Date of filing : 29.01.1999

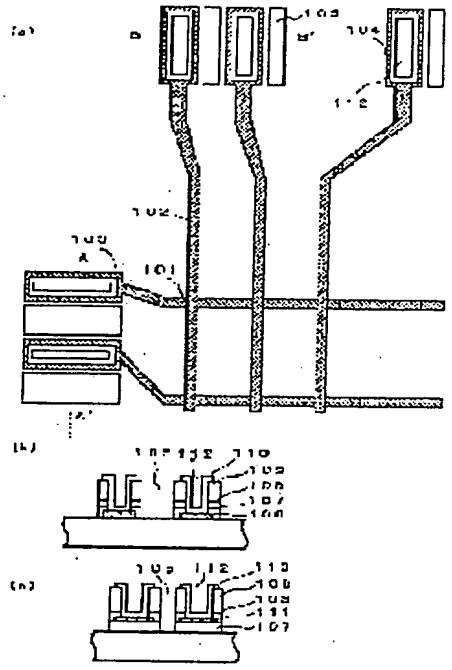
(71)Applicant : NEC CORP
(72)Inventor : SAKAMOTO MICHIAKI
SUGITANI CHOEI

(54) ACTIVE MATRIX TYPE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a means for well connecting TABs and terminals with an active matrix type liquid crystal display device which overlaps pixel electrodes and wiring for the purpose of enhancing the aperture ratio, forms the layer as double layers of an organic film and a passivation film and executes the patterning thereof in the same manner.

SOLUTION: A dummy contact hole 105 is disposed between adjacent terminals, thereby, the conductive particles of ACF are made to remain on the organic film 109 to prevent the absence of the contact between the lower layer metal 106 of the terminals and the connecting line of the TAB. The contact hole 112 for connecting the upper layer transparent electrode 116 of the terminals and the lower layer metal 106 are composed of plural via holes, by which the conductive particles of the ACF on the upper layer transparent electrodes 110 are sufficiently made to remain and the connecting with the connecting wires of the TAB is improved.



LEGAL STATUS

[Date of request for examination] 24.03.1999

[Date of sending the examiner's decision of ejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]	
[Patent number]	3139549
[Date of registration]	15.12.2000
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an active matrix liquid crystal display. Furthermore, it is related wit the configuration of the terminal area electrically connected with an external driver element in detail.
[0002]
[Description of the Prior Art] The active matrix liquid crystal display is known as a flat-panel display of space-savin and a low power. Drawing 11 expresses the concept of the conventional active matrix liquid crystal display, (a) show the configuration and (b) shows the equal circuit of a TFT substrate. This active matrix liquid crystal indicating equipment had the thin film transistor (TFT) substrate 1101 and the color filter substrate (henceforth, CF substrate) 1102, and has taken the structure which pinches the Twisted Nematic (TN) liquid crystal among these. The TFT substrate 1101 is connected to the thin film transistor (TFT) 1109 two or more pixel electrodes 1106 are formed on the matrix, and are [thin film transistor] switching elements for this pixel electrode 1106. The scan wiring 1107 which supplies a scan signal is connected to the gate electrode of TFT, the data line 1108 which inputs a status signal is connected to a drain electrode, and TFT is driven. The terminal 1110 for inputting a scan signal and a status signal is formed around the TFT substrate 1101, and it connects with the signal-processing substrate (TAB:Tape Automated Bonding) 1103. Furthermore, TAB1103 is connected to the external printed circuit board 1104. Moreover, the CF substrate 1102 comes to have a protection-from-light layer aiming at the RGB pigmented layer and protection from light which corresponded for every counterelectrode and pixel.
[0003] Drawing 12 is a unit element child's top view and sectional view in the conventional active matrix liquid crystal display. The gate electrode 1206 which TFT1203 is formed on the TFT glass substrate 1215, and is connected to the scan wiring 1201, The gate dielectric film 1209 formed as covered the gate electrode 1206, So that the drain electrode 1208 connected to the signal wiring 1202 formed on gate dielectric film 1209, the source electrode 1207 connected to a pixel electrode, and these may be covered It is formed with the pixel electrode 1205 connected with the source electrode 1207 through the contact hole 1204 established in the passivation film 1210 which membranes were formed by carrying out, and the passivation film.
[0004] By the way, a terminal for an active matrix liquid crystal display to connect the external substrate TAB and each wiring around a display is formed as mentioned above. Drawing 13 expresses a gate side edge child and a data side edge child, and the top view, (b), and (c) of (a) are the sectional views in the A-A'line and B-B' line of (a) respectively. The gate side edge child 1303 has taken the configuration currently formed as the maximum upper layer so that the transparent electrode 1310 which the gate layer metal 1306 which forms a gate electrode etc. is formed, and a contact hole 1312 is formed in some fields on it, and forms a pixel electrode etc. may cover a gate layer metal. The data side edge child 1304 has taken the configuration formed as the maximum upper layer so that the transparent electrode 1310 which the data layer metal 1311 which forms a drain electrode etc. is formed, and a contact hole 1312 is formed in some fields on the upper metal, and forms a pixel electrode etc. may cover a data layer metal. These terminals are connected with the lead wire by the side of TAB heating and by pressurizing using the anisotropy electric conduction film (ACF) which is the thermosetting adhesives of the shape of a film which made homogeneity distribute a detailed electric conduction particle.
[0005] As passivation film of the conventional TFT substrate, inorganic film, such as SiN film, was used by the thickness of 200nm - 400nm, and a pixel electrode and wiring were not overlapped. However, recently, a pixel electrode and wiring are made to overlap and the technique which spreads a light transmission field is indicated by the U.S. Pat. No. 5641974 specification. In that case, on the inorganic passivation film, patterning of the organic film of further a low dielectric constant is carried out, it is formed about 2-4 micrometers, and is used for the purpose which reduces the capacity between a pixel electrode and signal wiring.

[0006] Drawing 14 is the top view (a) and sectional view (b) of a active-matrix substrate which used the above-mentioned organic film for the interlayer insulation film. Patterning of the passivation film 1410 is the same as usual. Patterning, such as a contact hole 1404, is performed by carrying out spin spreading of the organic film 1411, such as photosensitive acrylic resin, and performing exposure and development on the passivation film 1410. The organic film of a terminal area is removed at this time. Furthermore, the organic film is heat-hardened by postbake. Finally the pixel electrode 1405 is formed and it connects with the source electrode 1407 of TFT. With the technique currently indicated by the U.S. Pat. No. 5641974 specification as mentioned above, compared with the conventional active matrix liquid crystal display, a light transmission field is large, it is bright, and a liquid crystal display with the sufficient display engine performance is obtained. However, in order to carry out at another process, the count of patterning of patterning [patterning of the passivation film and] of the organic film increases, a process is complicated, and it has the trouble whose manufacturing cost increases.
[0007] In order to solve this, in Japanese Patent Application No. No. 323423 [09 to], the technique which uses the two-layer resist method and carries out patterning of the organic film and the passivation film to coincidence is proposed. Drawing 15 is a process flow at the time of the contact formation. Passivation film formation is the same as that of the conventional technique (drawing 15 (a)). After applying the organic film and a resist continuously, it exposes and wet etching of the organic film is performed to patterning and coincidence of a resist at the time of development (drawing 15 (b)). Then, dry etching etc. performs patterning of the passivation film for a resist and the organic film on a mask (drawing 15 (c)). The exfoliation liquid which finally dissolves only a resist alternatively performs resist exfoliation (drawing 15 (d)). Since the same mask performs patterning of the organic film and the passivation film at this time, the organic film of a terminal area field is unremovable.
[0008] The situation of connection of TAB608 and a terminal 601 is shown in drawing 6 . Generally, since the anisotropy electric conduction film distributes at homogeneity, the path of an electric conduction particle is about 2-4 micrometers. Since the thickness of the organic film is 2-4 micrometers, when many electric conduction particles remain on the organic film, the distance during the lower layer metal-tape career package (TCP) of a terminal becomes larger than electric conduction particle diameter, and it has the trouble that contact of a terminal and TCP cannot be taken good.
[0009]
[Problem(s) to be Solved by the Invention] On the U.S. Pat. No. 5641974 specifications, in the case of the active-matrix mold substrate which carries out patterning of the photosensitive acrylic resin on the passivation film, compared with the conventional active-matrix mold substrate, the count of patterning increased once, and it had the problem on which a routing counter increases in order to reduce the capacity between a pixel electrode and signal wiring. In order to solve this, the technique which makes the count of patterning a substrate and an EQC conventionally is indicated by using the two-layer resist method for JP,09-323423,A, and carrying out patterning of the organic film and the passivation film to it identically. In this case, in order that the organic film of a thick film might remain in a terminal area, when many electric conduction particles remained on the organic film, it had the trouble that contact of a terminal and TAB could not be taken good.
[0010] The purpose of this invention is in the active-matrix substrate which carries out patterning of the organic film and the passivation film identically to offer the terminal structure of taking contact of a terminal and TCP good.
[0011]
[Means for Solving the Problem] Namely, two or more switching elements and pixel electrodes with which this invention was formed in the shape of a matrix on the substrate, The metal with which it has scan wiring which controls this switching element, the signal wiring which supplies a data signal to this switching element, and the terminal which connects each wiring and an external driver element electrically, and this terminal forms said scan wiring or signal wiring, It has the passivation film formed on this metal, and the transparent electrode which forms said pixel electrode. In the active-matrix substrate which said metal and transparent electrode are connected to the passivation film through the transparent electrode formed in the contact hole by which opening was carried out, and the anisotropy electric conduction film comes to connect with an external driver element (1) Establish a dummy contact hole in the passivation film between ****** terminals. (2) -- said contact hole is formed from two or more larger minute beer halls or contact holes than the path of the electric conduction particle in the anisotropy electric conduction film -- (3) -- by preparing said contact hole outside a connection field with an external driver element [or] The active matrix liquid crystal display with which the resistance increase by the maldistribution of the electric conduction particle in the case of connecting with the anisotropy electric conduction film was prevented, and good contact was taken is offered.
[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail.
[0013] The contact hole 504 was opened in the organic film 510 formed on the metal membrane 502 like drawing 5 a the 1st experiment, the anisotropy electric conduction film (ACF) 506 was stuck in the terminal TEG 501 in which the transparent electrode 503 was formed, and the number of the electric conduction particles per [which remained o the organic film 510 between terminals] unit area was counted. The distance L between contact holes and the relatio of the number of the electric conduction particles in per unit area on the organic film are shown in drawing 8 . Moreover, when the distance between contact holes exceeds 40 micrometers from this, it turns out that the number of the electric conduction particles on the organic film is increasing. About 15 micrometers of electric conduction particles move this at the time of a pressure welding, and when the distance between contact holes is 40 micrometers or less, the electric conduction particle on the organic film is considered for falling to a contact hole. Drawing 9 is drawing having shown the lower layer metal through the anisotropy electric conduction film, the contact resistance between TAB, and the distance between contact holes. When contact resistance of a lower layer metal and TAB begins to increase rapidly from the hit to which the distance between contact holes exceeds 40 micrometers and 80 micrometers is exceeded from this, it becomes more than 100kohm, and becomes less practical. Although there is almost no electric conduction particle on the organic film and a metal and TCP were connected good through the electric conduction particle when this had a short distance between contact holes, it understood that many electric conduction particles remain on the organic film like drawing 6 when the distance between contact holes is long, the distance between a metal and TCP becomes (thickness of organic film) + (electric conduction particle diameter), and it becomes impossible to take contact good. However, the distance between terminals is usually formed in about 50-100 micrometers. This needs to take a still larger distance between contacts, if it becomes shorter than 50 micrometers, and alignment will be very difficult and will take the margin of contact formation into consideration, when connection with an external terminal is considered. Therefore, in this invention, by forming so that it may become about 3 to 20 times of about 10-50 micrometers, i.e., electric conduction particle diameter, the distance of the dummy contact hole 505 and a contact hole 504 can drop an electric conduction particle into a contact hole 504 and the dummy contact hole 505, and as shown in drawing 5 (b), it can take good contact.
[0014] The contact hole was opened in the organic film formed on the metal like drawing 7 as the 2nd experiment by two or more beer halls 704, and the transparent electrode 703 was formed on it. The anisotropy electric conduction film 706 was attached on it, and resistance between transparent electrode-TAB was measured by carrying out a pressure welding. Area of S1 and a transparent electrode is set to S2 for the gross area of a beer hall, and the relational expression of duty ratio Duty=S1/S2 and resistance is shown in drawing 10 . It turned out the range of 0.01 <=Duty<=0.3, and that it becomes low resistance in 0.05 <=Duty<=0.3 especially. Duty> The reason resistance increases by 0.3 is presumed because the number of the electric conduction particles on a transparent electrode is inadequate. Since the reason resistance increases by Duty<0.01 has the too small magnitude of a beer hall 704, it is considered for the contact resistance through a beer hall of a transparent electrode 703 and the lower layer metal 702 to increase. In addition, what is necessary is just to carry out magnitude of the beer hall here to more than the overall diameter of the electric conduction particle in ACF. Consequently, good contact can be taken as shown in drawing 7 (b).
[0015]
[Example] It cannot be overemphasized that this invention is not limited only to these examples and it can change suitably within the limits of this invention hereafter although an example explains this invention concretely.
[0016] Example 1 drawing 2 is the schematic diagram showing the liquid crystal display of this example. The liquid crystal display of this example has TAB203 of a large number which constitute the driver for driving the thin film transistor substrate (TFT substrate) 201, the color filter substrate (CF substrate) 202, the liquid crystal panel that consists of liquid crystal layers pinched by them, and this liquid crystal panel. The above TAB 203 is put side by side on the printed circuit board 204 of two sheets arranged along with two sides of a liquid crystal panel which make a rectangle, and the base film of each TAB is connected with the printed circuit board for signal processing by soldering. The bare chip 210 as an integrated circuit was carried on the base film, and Above TAB was connected with the TAB lead wire 209 each terminal of whose of a bare chip is the circuit pattern formed in the base film. These TAB203 is electrically connected with the terminal 208 on a TFT substrate by ACF205.
[0017] The display of the TFT substrate which constitutes a liquid crystal panel is the same configuration as Japanese Patent Application No. No. 323423 [nine to]. In addition, the thickness of the organic film could be about 3 micrometers. The terminal pulled out from scan wiring and signal wiring is prepared around a TFT substrate, and it is collected for every terminal block formed from a TAB electrode and the terminal of the same number.
[0018] Drawing 1 is the top view and sectional view of a terminal area linked to external TAB. A gate terminal 103

consists of the gate layer metal 106, gate dielectric film 107, passivation film 108, organic film 109, and a transparent electrode 110, and a transparent electrode 110 is connected with the gate layer metal 106 through a contact hole 112. Magnitude of the gate metal which forms a gate terminal 103 was set to 70x200 micrometers, distance between terminals was set to 100 micrometers, and the contact hole was set to 50x150 micrometers.

[0019] From the result of the above-mentioned fundamental experiment, the 80x200-micrometer dummy contact hole 105 was established in the organic film between terminals so that many electric conduction particles in the anisotropy electric conduction film might not remain on the organic film. The distance from the edge of a terminal to the dummy contact hole 105 is set to 10 micrometers, and it was made for the electric conduction particle of ACF to fall to a contact hole 112 or the dummy contact hole 105 by this.

[0020] The data terminal 104 consists of the data layer metal 111, passivation film 108, organic film 109, and a transparent electrode 110, and a transparent electrode 110 is connected with the data layer metal 111 through a contact hole 112. Magnitude of the data layer metal 111 which forms the data terminal 104 was set to 70x200 micrometers, distance between terminals was set to 50 micrometers, and the contact hole 112 was set to 50x150 micrometers. The 30micrometerx200micrometer dummy contact hole 105 was established in the organic film between terminals.

[0021] Through the anisotropy electric conduction film ACF, heating sticking by pressure is carried out and the lead section of these terminals and TAB is mounted. Many electric conduction particles which come to give nickel plating and gold plate to a detailed globular form plastics bead front face as anisotropy electric conduction film are distributed to the binder which consists of an epoxy resin, and it is constituted. In addition, the appearance of the electric conduction particle of the anisotropy electric conduction film is 5 micrometers, and 10,000 consistencies /of an electric conduction particle are [mm] 2. This anisotropy electric conduction film was carried out heating and a pressure welding, and it connected with TAB. At this time, an electric conduction particle hardly remained on the organic film by having formed the dummy contact hole 105. Moreover, the path of the crushed electric conduction particle is set to about 3 micrometers, and the contact resistance between terminal-TCP can take less than 100ohms and good contact.

[0022] Example 2 drawing 3 is the top view and sectional view of a terminal area linked to external TAB. In addition, since the configuration of a liquid crystal display and the configuration of a viewing area are the same as the 1st example, explanation is omitted. A gate terminal 303 consists of the gate layer metal 306, gate dielectric film 307, passivation film 308, organic film 309, and a transparent electrode 310, and a transparent electrode 310 is connected with the gate layer metal 306 through a contact hole. The magnitude of the gate layer metal 306 which forms a terminal, and a transparent electrode 310 is the same as an example 1, and formed ten beer halls 305 with a magnitude of 10x10 micrometers as a contact hole. The data terminal 304 also used the gate layer metal 306 as the data layer metal 311, and also it considered as the same configuration.

[0023] The anisotropy electric conduction film was made these terminals heating and a pressure welding, and it connected with TAB. At this time, the DUTY ratio of contact hole area and transparent electrode area is 0.1, and contact resistance of terminal-TCP is set to less than 100ohms, and can take good contact.

[0024] Example 3 drawing 4 is the top view and sectional view of a terminal area linked to external TAB. In addition, since the configuration of a viewing area is the same as the 1st example, explanation is omitted. A gate terminal 403 consists of the gate layer metal 406, gate dielectric film 407, passivation film 408, organic film 409, and a transparent electrode 410, and a transparent electrode 410 is connected with the gate layer metal 406 through a contact hole 405. The magnitude of the gate layer metal which forms a terminal, and a transparent electrode was the same as the example 1, and the contact hole avoided the TAB pressure-welding field 404, and formed the beer hall 405 with a magnitude of 30x20 micrometers. The same is said of a data side edge child.

[0025] The anisotropy electric conduction film was made these terminals heating and a pressure welding, and it connected with TAB. At this time, the DUTY ratio of contact hole area and transparent electrode area is set to 0.06, and contact resistance of terminal-TAB is less than 100ohms, and can take good contact.

[0026]

[Effect of the Invention] As explained above, according to this invention, in the active-matrix mold substrate with which the organic film is prepared in the terminal area, it is stabilized at the time of mounting of TCP, and connection between TCP and a terminal can be made. This prepares a dummy contact hole between terminals, and is obtained by lessening enough the electric conduction particle of the anisotropy electric conduction film on the organic film. Moreover, surface ratio of the transparence metal which forms a terminal, and a contact hole is made less than into 0.01 to 0.3, and it is obtained also when the electric conduction particle of the anisotropy electric conduction film makes it fully remain on a transparence metal.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Two or more switching elements and pixel electrodes which were formed in the shape of a matrix on the substrate, The metal with which it has scan wiring which controls this switching element, the signal wiring which supplies a data signal to this switching element, and the terminal which connects each wiring and an external driver element electrically, and this terminal forms said each wiring, It has the interlayer film formed on this metal, and the transparent electrode which forms said pixel electrode. In the active-matrix substrate which said metal and transparen electrode are connected to said interlayer film through the transparent electrode formed in the contact hole by which opening was carried out, and the anisotropy electric conduction film comes to connect with an external driver elemen The active matrix liquid crystal display characterized by establishing the dummy contact hole in the interlayer film between ****** terminals.
[Claim 2] Two or more switching elements and pixel electrodes which were formed in the shape of a matrix on the substrate, The metal with which it has scan wiring which controls this switching element, the signal wiring which supplies a data signal to this switching element, and the terminal which connects each wiring and an external driver element electrically, and this terminal forms said each wiring, It has the interlayer film formed on this metal, and the transparent electrode which forms said pixel electrode. In the active-matrix substrate which was formed in the contact hole where opening of said metal and transparent electrode was carried out to said interlayer film and which is **********(ed) and connected and the anisotropy electric conduction film comes to connect with an external driver element Said contact hole is an active matrix liquid crystal display characterized by consisting of two or more minute beer halls or contact holes more than the overall diameter of the electric conduction particle in the anisotropy electric conduction film.
Claim 3] Two or more switching elements and pixel electrodes which were formed in the shape of a matrix on the substrate, The metal with which it has scan wiring which controls this switching element, the signal wiring which supplies a data signal to this switching element, and the terminal which connects each wiring and an external driver element electrically, and this terminal forms said each wiring, It has the interlayer film formed on this metal, and the transparent electrode which forms said pixel electrode. In the active-matrix substrate which said metal and transparent electrode are connected to said interlayer film through the transparent electrode formed in the contact hole by which opening was carried out, and the anisotropy electric conduction film comes to connect with an external driver element Said contact hole is an active matrix liquid crystal display characterized by being outside a connection field with an external driver element.
Claim 4] The ratio of the area of said two or more beer halls or contact hole, and transparent electrode on said terminal is an active matrix liquid crystal display according to claim 2 or 3 characterized by or more 0.01 being 0.3 or less.
Claim 5] Said interlayer film is an active matrix liquid crystal display given in any 1 term of claims 1-4 characterized by consisting of a laminated structure of the organic film or the organic film, and the inorganic passivation film.

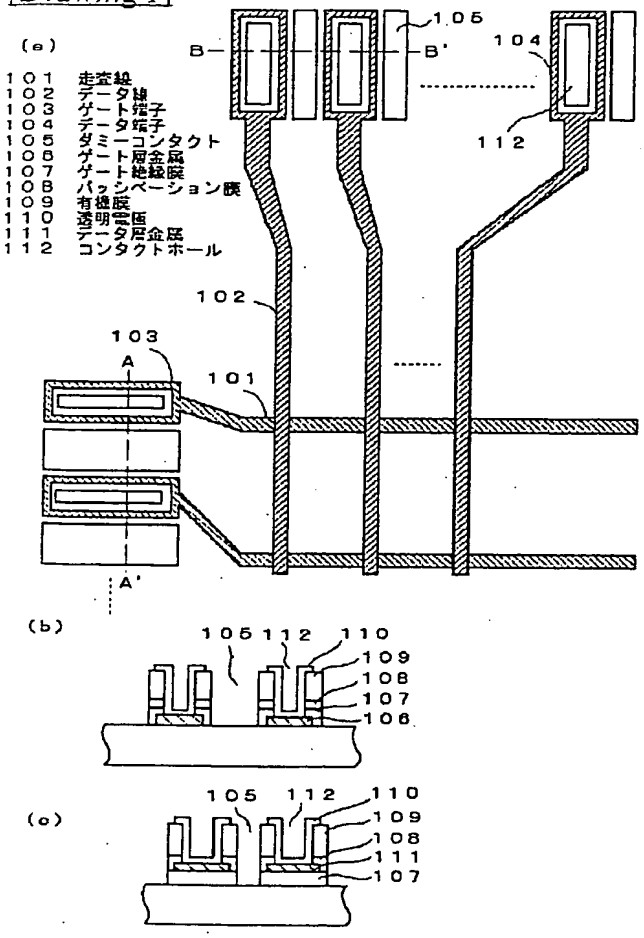
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

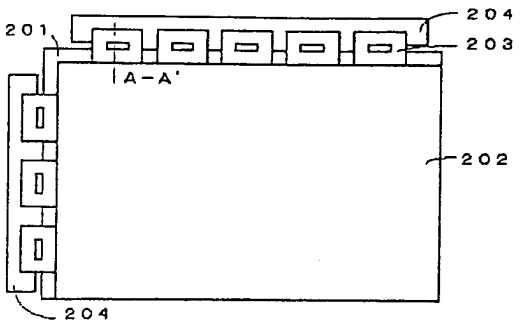
DRAWINGS

[Drawing 1]

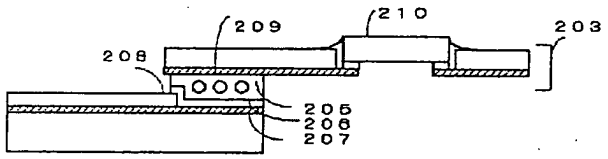


Drawing 2]

(a)

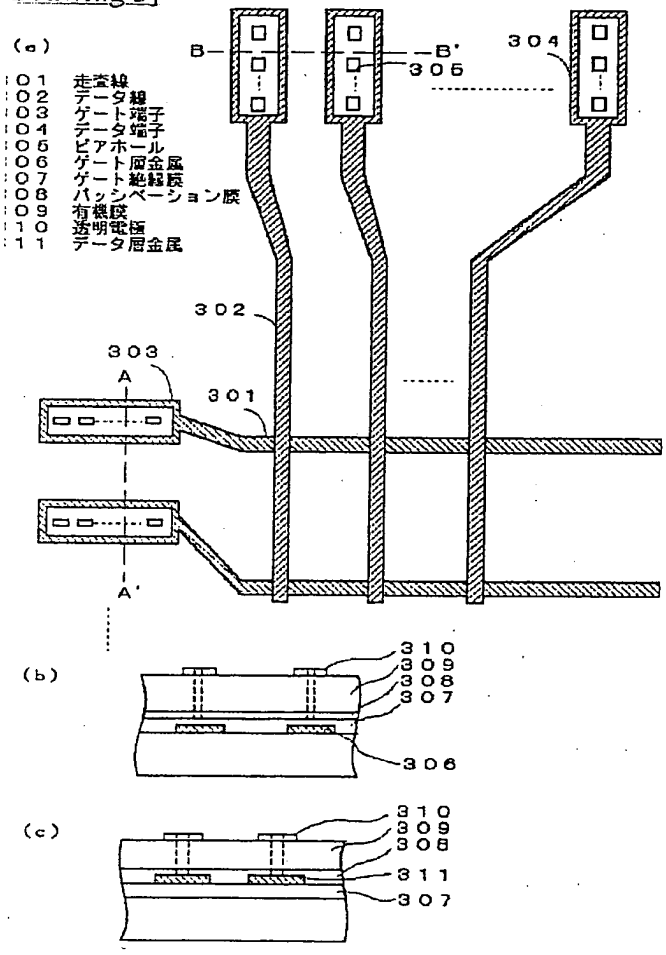


(b)

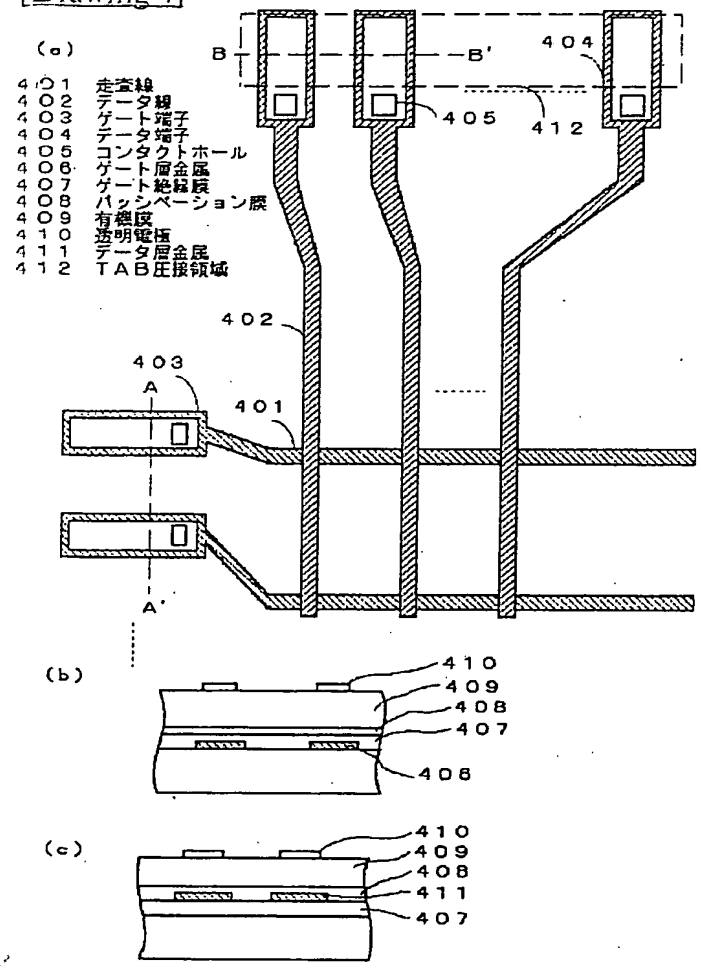


201 TFT基板
202 CF基板
203 TAB
204 プリント基板
205 ACF
206 透明電極
207 金属
208 端子
209 TABリード線

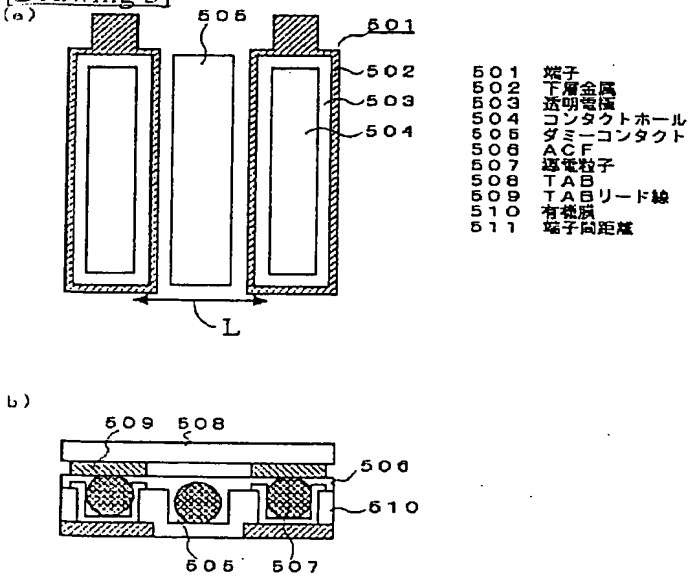
Drawing 3]



[Drawing 4]

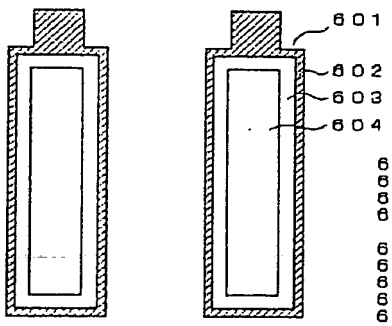


[Drawing 5]



Drawing 6]

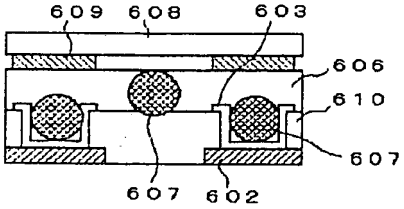
(a)



601 端子
602 下層金属
603 透明電極
604 コンタクトホール

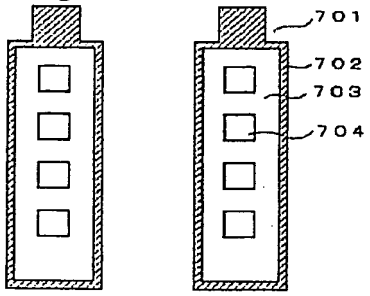
606 ACF
607 導電粒子
608 TAB
609 TABリード線
610 有機膜

(b)



[Drawing 7]

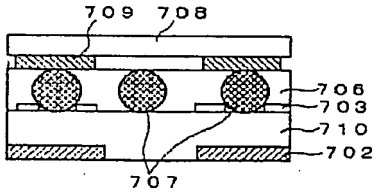
(a)



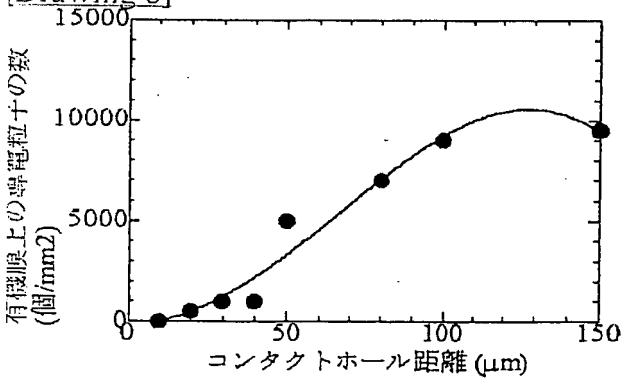
701 端子
702 下層金属
703 透明電極
704 ビアコンタクト

706 ACF
707 導電粒子
708 TAB
709 TABリード線
710 有機膜

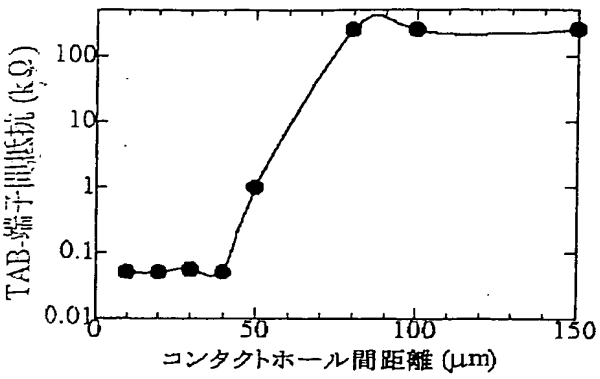
(b)



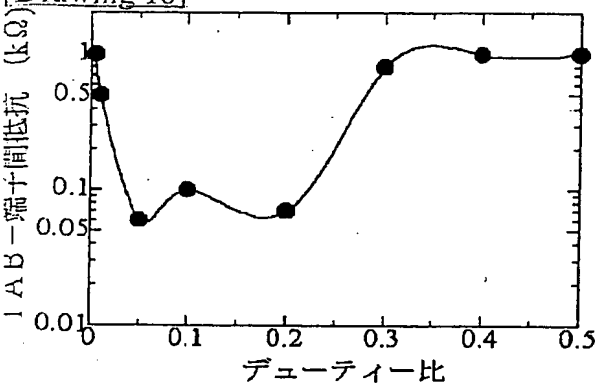
[Drawing 8]



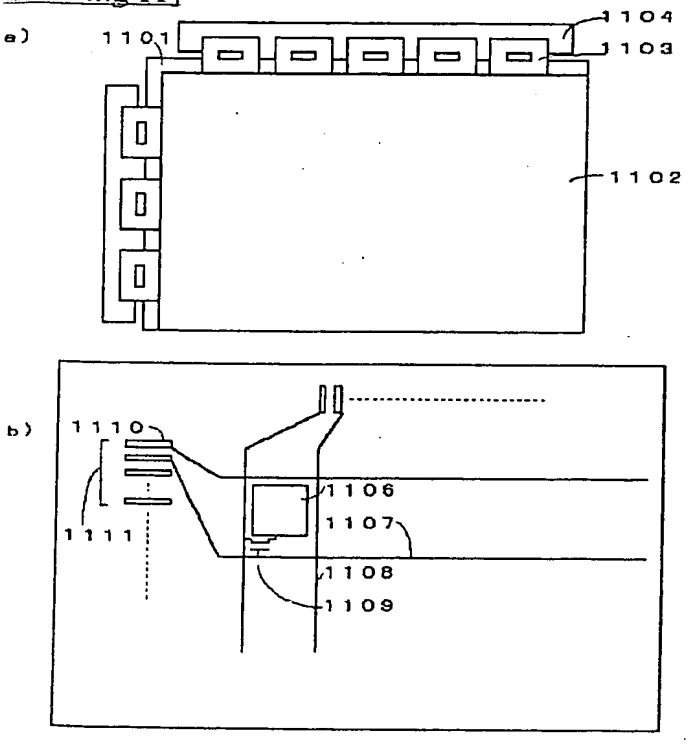
[Drawing 9]



[Drawing 10]

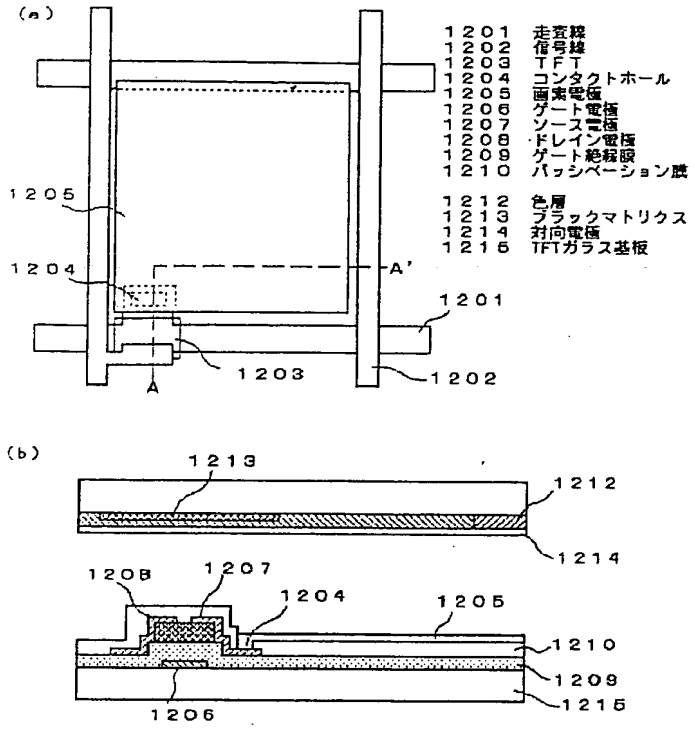


Drawing 11]

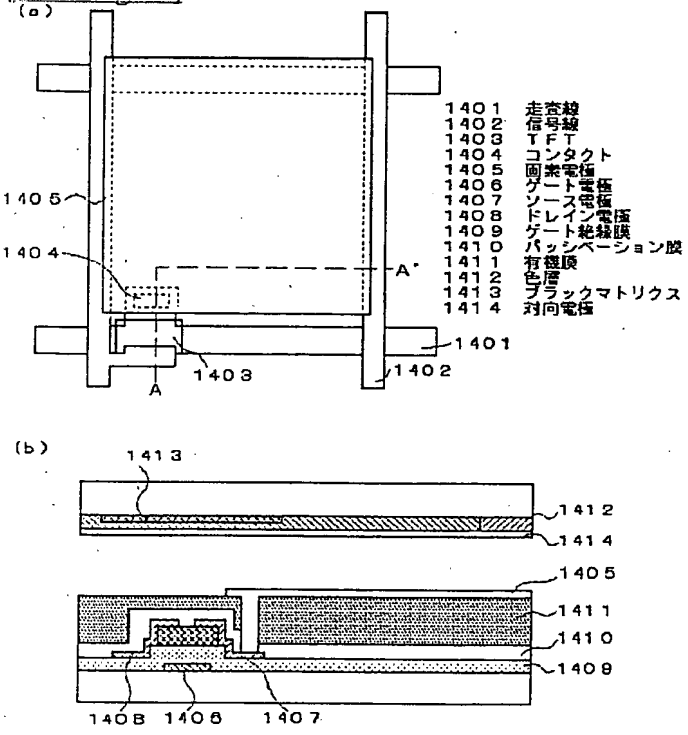


1101 TFT基板　1102 CF基板
1103 TAB　1104 プリント基板
1106 透明電極
1107 走査線　1108 信号線
1109 TFT　1110 端子
1111 端子ブロック

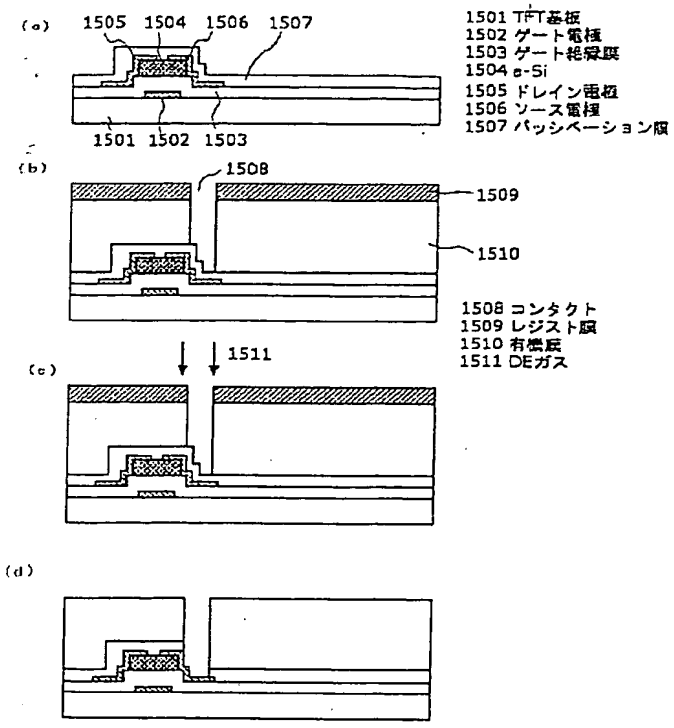
Drawing 12]



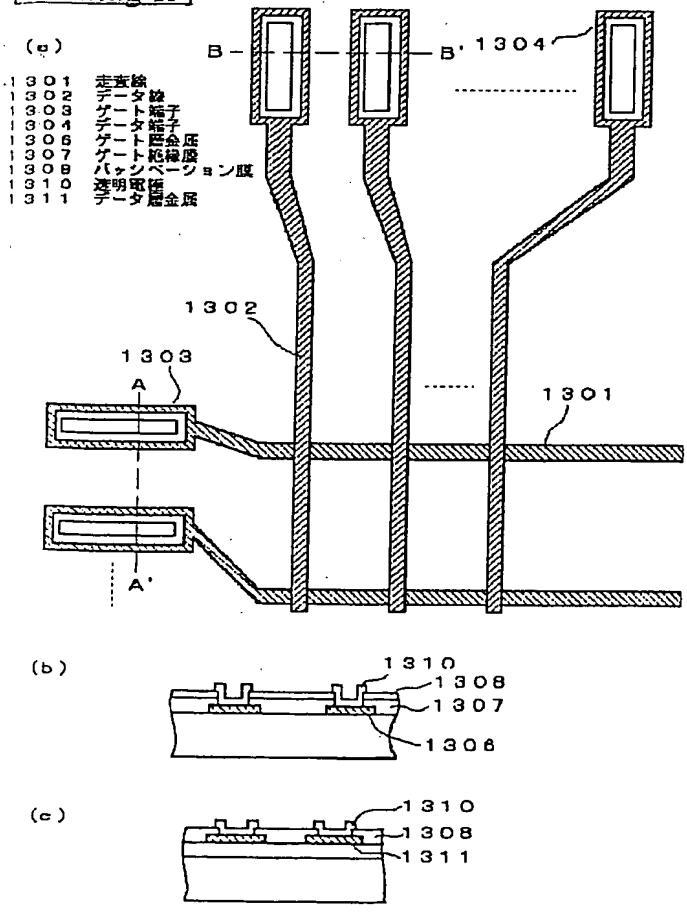
[Drawing 14]



[Drawing 15]



[Drawing 13]



Translation done.]